



FRD Activities Report September 2000



Research Programs

VTMX-CBNP 2000

The final preparations for deployment to VTMX-CBNP 2000 were completed this month. The photo in Fig. 1 shows the van crew is already to go. The schedule calls for six coordinated SF₆ and perfluorocarbon tracer releases. To reduce cost, the crew will deploy out of Idaho Falls. But this makes scheduling tricky, with finicky weather in control. The van crew, consisting of Tim Crawford, Roger Carter, Brad Reese, Rick Eckman, Jeff French, Neil Hukari, Joyce Silvester, and Tom Strong, will be on call the entire month of October. They will have only 18 hours following notification of a planned deployment to prepare the calibration gases for the real-time analyzers and the duplicate and blank bag samplers before they must be on the road.

The van crew has a big job managing both the mobile real-time SF₆ analyzers and the whole-air



Figure 1. Staff ready for Salt Lake deployment of continuous analyzers and whole-air samplers.

bag samplers. Upon arrival, they will immediately deploy all of FRD's whole-air samplers on eight different servicing routes that extend to 6 km from the release site. In addition, closely spaced samplers placed in ½ block increments will also be deployed. Following the whole-air sampler deployment, a 6-hour release will begin under the supervision of Randy Johnson. The van crew will then mobilize, looking for the SF₆ plume and measuring its concentrations. At the end of

the release, the crew will be able to rest before retrieving the whole-air samplers and returning to Idaho Falls.

Upon return of the van crew to Idaho Falls, the gas lab will be activated. Debbie Lacroix, Roger Carter, and Bill Behymer will carry out the analysis of the bag samplers and the mobile analyzers. Still others are involved with support. Shane Beard will ensure the proper operation of the whole air-bag samplers. Jerry Crescenti will oversee the deployment and operation of a 915-MHz radar wind profiler, Doppler sodar, and 10-m tower. In addition, Jerry Crescenti will act as the FRD duty forecaster and assume all EOC responsibilities while most of the FRD staff are in Salt Lake City conducting the intensive sampling. Kirk Clawson will deploy and operate two sonic anemometers. The principal investigator is Kirk Clawson. All of the FRD staff are involved to ensure a successful project. (Kirk.Clawson@noaa.gov and FRD staff)

As part of set up for VTMX-CBNP, the accuracy of the TGA-4000s was tested by allowing them to sample air containing a known concentration of SF₆ and comparing the concentration reported by the TGA-4000 with the known concentration. Well over 50 measurements were made in a variety of environments. Preliminary examination of the results show an average error of about 8%. Since both the calibration gases and the input sample concentrations are reported to $\pm 5\%$, this result is as good as could be expected. (Roger.Carter@noaa.gov, Debbie Lacroix)

The 915-MHz radar wind profiler and phased-array Doppler sodar will be deployed in an open parking lot on the grounds of the Raging Waters entertainment complex. This site, southwest of downtown Salt Lake City, was secured for the upcoming VTMX field study. In addition, a 10-m tower will be installed for the measurement of surface wind, air temperature, and relative humidity. (Jerry.Crescenti@noaa.gov)

Refractive Turbulence Study

Analysis continues on data collected during the August 2000 test flights in Idaho Falls. Research is focusing on time response and temperature resolution for the new FRD Fast, Ultra-Sensitive Temperature Probe (FUST) compared to the Warsaw University UFT and the BAT micro-bead. Additionally, we are investigating recovery factor sensitivity to variation in flow angle. This preliminary work has led to a paper to be presented at the AMS annual meeting in January. The paper may be viewed at:

http://www.noaa.inel.gov/frd/Personnel/Jeff/fust_conf.pdf.

The primary conclusions of this work are that both the FUST and the UFT recover temperature are independent of the flow angle. Also, the FUST has more noise (0.05 C) and a slower response (~ 0.1 s) than what we were attempting to achieve (0.01 C, 0.02 s). Therefore, we will continue with laboratory testing, looking to remove the housing for future flight as it seems an unnecessary complication of the problem at hand. Additional test will begin in November. For these, emphasis will be placed on collecting data in regions of high optical turbulence. (Jeff.French@noaa.gov, Tim Crawford and Owen Cote)

Extreme Turbulence (ET) Probe

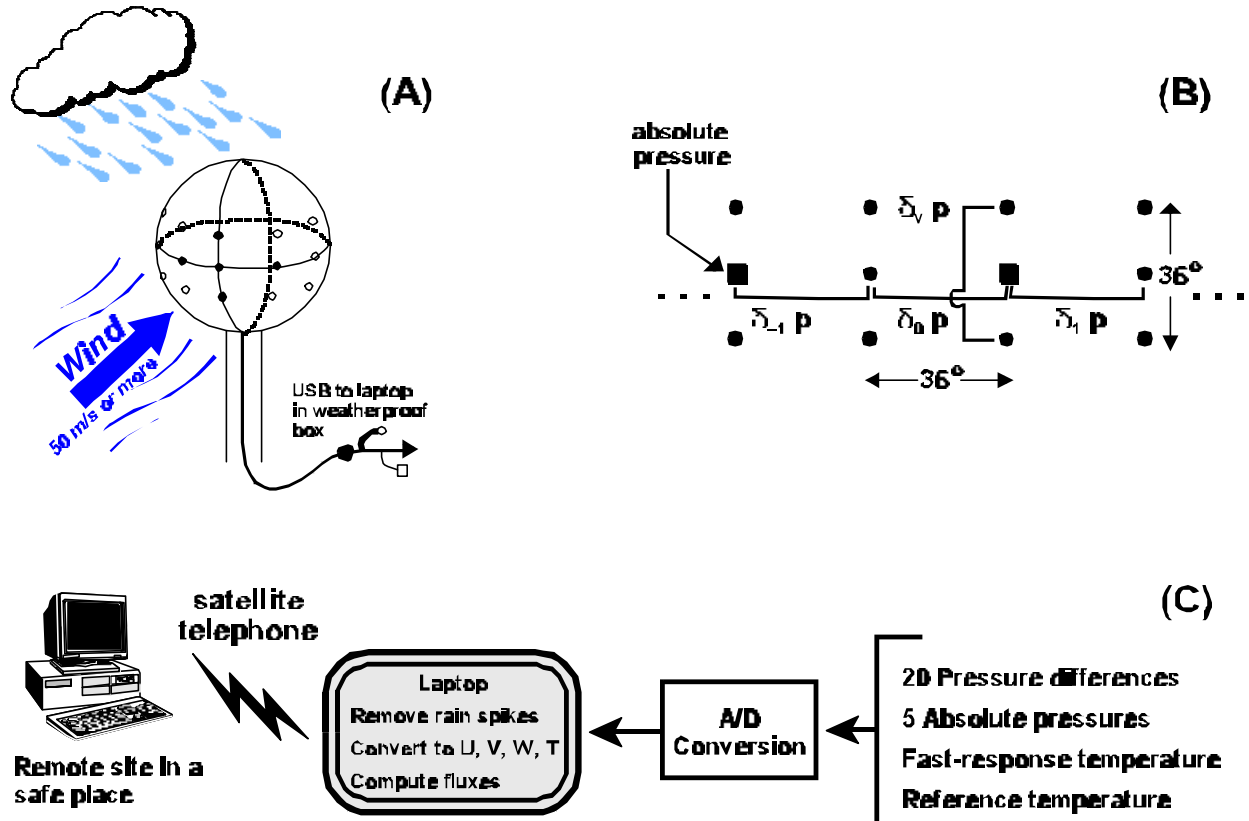


Figure 2. The ET probe concept. (A) General appearance. (B) Schematic of port arrangement and pressure measurement. Absolute pressure, along with pressure difference, is measured at squares. Vertical pressure differences skip the “equator”, reducing the required number of sensors. (C) Schematic information path from sensors in hurricane to receiver in safe place.

Toward the end FY-2000, our proposal “Development and Deployment of an Extreme Turbulence (ET) Probe” was co-funded by ONR CBLAST program and by OAR under the U. S. Weather Research Program/Hurricane Landfall. Under this project, we will develop and deploy an innovative ET probe for acquiring surface-based turbulent heat and momentum flux in hurricane-force wind and rain conditions. Deployment during landfalling hurricanes will begin in FY 2002. The ET probe concept is illustrated in Fig. 2.

The ET Probe design and development is now well underway with the prototype housing and electronics nearly complete. Dave Auble (Fig. 3) is holding the newly finished prototype electronic sensor boards. Visible are the 30 pressure sensors necessary to make the ET probe function in extreme wind and independent of wind direction. The sensor boards, A/D system and other components will be housed within a large 40-cm sphere. To learn more about the ET probe and our hurricane research, visit



Figure 3. Dave Auble (ATDD) holding the new ET Probe electronics.

<http://www.noaa.inel.gov/frd/Capabilities/ETprobe>. (Tim.Crawford@noaa.gov with FRD and ATDD staff)

Central California Ozone Study (CCOS)

The Central California Ozone Study (CCOS) ended on September 30, 2000 after a four-month observation period. Quality control screening efforts have shown that these tower systems worked exceptionally well during the course of the experiment with a few minor problems. The four tower systems located in southern California (Kettleman City, Piedras Blancas Lighthouse, Carrizo Plain, and McKittrick) were decommissioned between September 30 and October 2. In addition, the radar wind profiler and Doppler sodar were taken offline and were prepared for transport to Salt Lake City for participation in VTMX. The five towers located in northern California (Point Reyes, Suisun City, Granite Bay, Bella Vista, and Shasta Lake) will be retrieved sometime in October or early November. A final quality-controlled data set will be generated and delivered to the California Air Resources Board (CARB). A data report will also be generated summarizing FRD's contribution to CCOS. (Jerry.Crescenti@noaa.gov, Randy Johnson, Neil Hukari, Shane Beard, and Tom Strong)

Wave Profile Experiment (WAPEX)

Data acquired by the LongEZ during the Wave Profile Experiment (WAPEX) off the Outer Banks of North Carolina in November 1998 will be reprocessed to correct for a heading offset (bias). In addition, the new Flykin software implemented during the intensive observation period of the Shoaling Waves Experiment (SHOWEX) in November 1999 will also be used on the WAPEX data. These differentially-corrected GPS algorithms will reduce the variance in winds by a factor of two to three from that of the previously used software. (Jerry.Crescenti@noaa.gov, Jeff French, Tim Crawford)

Cooperative Research with INEEL

INEEL Emergency Operations Center (EOC) Support

Yet another range fire burned 8000 acres on the INEEL from September 17 to 18. Lightning from thunderstorms passing over the INEEL on Saturday, September 16 ignited a small fire which smoldered for about a day. On Sunday afternoon, the small fire which had gone undetected for nearly a day, began to quickly spread when strong southwesterly winds became established.. The EOC was activated soon after the fire was discovered several miles north of the Idaho Nuclear and Technology Engineering Center (INTEC) and the Power Burst Facility (PBF). Jerry Crescenti responded and reported to the EOC on Sunday afternoon. He provided timely short-range weather forecasts to EOC personnel during the evening. At about 11 p.m. on Sunday night, most of the EOC personnel were sent home when most of the fire was contained and winds had subsided to less than 2-3 m s⁻¹. (Jerry.Crescenti@noaa.gov)

During the month of September, the INEEL Emergency Planning group utilized "fake weather" in three separate emergency response drills. These are special data sets created to force the meteorological conditions to match the drill scenario. The fake data will be displayed on the

workstations of the drill participants, allowing them to react exactly as they would in a real emergency situation. (Roger.Carter@noaa.gov)

INEEL Mesoscale Meteorological Network

A new station was added to the INEEL Mesoscale Meteorological Network at the end of September. It is at the top of Big Southern Butte which is located to the south of the INEEL site. It is at an elevation of over 2280 m (7500 ft) above sea level and approximately 760 m (2500 ft) above the INEEL site. The location will provide measurements of mountain top winds and also serve as a backup radio repeater for the network, which should increase the reliability of the entire network. Data collection from the new station will begin the first week of October. (Randy.Johnson@noaa.gov, Tom Strong, Shane Beard, Roger Carter, Kirk Clawson)

INEEL Wildfire Modeling

A presentation on FRD's fire modeling efforts was provided to the INEEL Monitoring and Surveillance Committee on 28 September. The discussion included an overview of the fuel and meteorological variables that are important for fire development. The fire model developed for use in the INEEL Emergency Operations Center was also discussed, as was possible future directions in FRD's fire modeling effort. (Richard.Eckman@noaa.gov)

The wildfire issue is also receiving attention at the upper levels of NOAA management as a result of this summer's fires in the West. A meeting took place in Washington D.C. in the middle of September on the possibility of a NOAA initiative related to wildfires. The meeting included participants from ARL Headquarters. Most of the interest at that level appears to be directed towards the health effects of the smoke. At ARL Headquarter's request, FRD sent some background information on its activities related to fire modeling. Additional information was sent on FRD's capabilities for collecting *in situ* meteorological and air-quality measurements that could be applied to fire studies. For example, FRD already has instruments capable of measuring particulate concentrations and visual range. These instruments could be mounted on FRD's airborne research platform and used to study fire plumes. (Richard.Eckman@noaa.gov)

INEEL Mesoscale Modeling

The 15-hour MM5 simulations of Southeast Idaho continued to be run on a nearly daily basis during September. The Eta model output used to initialize MM5 is now being downloaded from a NWS ftp server instead of the NCEP server used previously. The NCEP server was not supported on a 7/24 basis, and sometimes skipped over Eta model runs. The NWS server is supported on a 7/24 basis. Some additional plotting capabilities for the MM5 output were provided by the recent acquisition of the NCAR Graphics library. The University Corporation for Atmospheric Research (UCAR) recently made this plotting package freely available on the Internet. MM5 has some built-in plotting utilities that are based on NCAR Graphics, and these utilities are now being used in the Southeast Idaho simulations. (Richard.Eckman@noaa.gov)

INEEL Citizen's Advisory Board

The INEEL Citizen's Advisory Board meets monthly to monitor DOE-Idaho activities and to make recommendations to the DOE regarding public safety. The September meeting of the board was

held in Jackson, WY, which is the location of the most recent and most vocal opposition to INEEL activities. The various monitoring groups at the INEEL, such as the State of Idaho Oversight Program and the USGS, were invited by the Board to present detailed information of their monitoring efforts. Kirk Clawson represented FRD at the meeting and gave a presentation of our meteorological monitoring efforts, including an account of our joint community monitoring activities with the Shoshone-Bannock Indian Tribes. (Kirk.Clawson@noaa.gov)

Other Research

TANS-INS-LiDAR platform attitude comparison

Work continues on a cooperative study between C. Wayne Wright at NASA-Wallops Island and Jeff French at ARL/FRD. This work focuses on data collected during November 1999 using the NOAA Twin Otter. Three systems were mounted on the Twin Otter to independently determine the platform attitude. Using the NASA Advanced Topographic Mapping Lidar as a ground truth, attitude solutions from an INS and TANS-GPS are compared. Preliminary results from this work will be presented at the 2001 AMS annual meeting. The conference paper may be viewed at: <http://www.noaa.inel.gov/frd/Personnel/Jeff/attitudes.conf.pdf>. (Jeff.French@noaa.gov, Tim Crawford, and Owen Cote)

Other Activities

FY-2000 Year-End Financial Planning and Budgeting

As a result of this year's many projects and accounting changes, FY-2000 ended as one of the most challenging years and in the middle of extensive VTMX preparations. Regardless, all invoices for credit card purchases, blanket purchase agreements, and purchase orders, were submitted along with accruals obligating purchases or travel not yet billed under FY-2000. The PMIR Reports are now under review. Focus now shifts to planning for FY-2001. FY-2000 funds for eight reimbursable projects currently underway will be carried over. The paperwork for three new Office of Naval Research projects, AFTAC and VTMX is already well underway. Financial Operating Plan Worksheets for Reimbursable and O&RF funds were submitted to ARL. This new activity is required as a Financial Management Center. (paula.fee@noaa.gov)

Papers

The first seven volumes of FRD publications have been received from the printer. All publications by FRD staff will be bound in hard cover and kept as a permanent archive. The volumes containing the next five years of FRD publications will go to the printer shortly. (Joyce Silvester@noaa.gov, and staff)

Crawford, T. L., G. H. Crescenti, and J. M. Hacker, 2001: Small environmental research aircraft: the future of airborne geoscience. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Jan 14-19, Amer. Meteor. Soc., paper 5.6. (<http://www.noaa.inel.gov/frd/Personnel/Tim/ams01a.pdf>)

Dobosy, R. J., T. L. Crawford, D. L. Auble, G. H. Crescenti, and R. C. Johnson, 2001: The extreme turbulence (ET) probe for measuring boundary-layer turbulence during hurricane-force winds. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Jan 14-19, Amer. Meteor. Soc., paper 2.6. (<http://www.noaa.inel.gov/frd/Personnel/Tim/Etabq41.pdf>)

French, J. R., T. L. Crawford, R. C. Johnson, and O. C. Coté, 2001: A high-resolution temperature probe for airborne measurements. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Jan 14-19, Amer. Meteor. Soc., paper 5.10. (http://www.noaa.inel.gov/frd/Personnel/Jeff/fust_conf.pdf)

Johnson, R. C., R. G. Carter, S. Businger, G. Barnes, and J. Businger, 2001: Improved smart balloon to better characterize hurricane boundary-layer inflow. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Jan 14-19, Amer. Meteor. Soc., paper P1.1. ([http://www.noaa.inel.gov/frd/Personnel/Randy/AMS Hurricane Balloon Paper J.wpd](http://www.noaa.inel.gov/frd/Personnel/Randy/AMS_Hurricane_Balloon_Paper_J.wpd)) October 4, 2000

Vandemark, D., P. D. Mourad, S. A. Bailey, T. L. Crawford, C. A. Vogel, J. Sun, and B. Chapron, 2000: Measured changes in ocean surface roughness due to atmospheric boundary layer rolls. *Journal of Geophysical Research*, *accepted*.

Wright, C. W., and J. R. French, 2001: Comparison of aircraft attitude determination by GPS, INS, and airborne laser: preliminary results. Preprint, *Eleventh Symposium on Meteorological Observations and Instrumentation*, Albuquerque, NM, Jan 14-19, Amer. Meteor. Soc., paper 5.9. (<http://www.noaa.inel.gov/frd/Personnel/Jeff/attitudes.conf.pdf>)

Carter, R. G., and R. Ridenour, 2000: An Improved Short Term Transport and Dispersion Forecasting Method. Accepted for publication in *Radiation Protection Management*.

Papers Reviewed

Bradley, S. G., V. J. Hipkin, and K. Underwood, 2000: The relationship between the phase of a sodar signal and atmospheric temperature. *J. Atmos Oceanic Technol.*, review by Jerry Crescenti.

Travel

Jerry Crescenti traveled to attend a Shoaling Waves Experiment (SHOWEX) workshop held in Corvallis, Oregon from September 6-7, 2000.

Jerry Crescenti traveled to Salt Lake City on September 12, 2000 to search and secure a site for the radar wind profiler and Doppler sodar for the upcoming Vertical Transport and Mixing Experiment (VTMX).

Kirk Clawson traveled to Jackson, Wyoming, on September 19-20 to give a presentation to the INEEL Citizen's Advisory Board.

Kirk Clawson and Shane Beard traveled to Salt Lake City, Utah, on September 18-22 to select sampler locations, etc. for the upcoming Vertical Transport and Mixing Experiment (VTMX)/ Chemical and Biological Nonproliferation Program (CBNP). Field measurements will be conducted in October.

Training

Joyce Silvester enrolled in the National Education Foundation (NEF) CyberLearning program to improve her computer/IT skills. The self study or instructor-lead courses cover all levels and almost all topics including computer basics, internet basics, web design basics, networking basics, etc.